CAPABILITY LEAPFROGGING IN THE JAPANESE IT SERVICES INDUSTRY

Research-in-Progress

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Abstract

The focal question that we address is about how firms transition their IT product capabilities to the IT services capabilities. In particular, we were interested in exploring the unexpected observation that some incumbent firms in the Japanese IT industry were able to leapfrog capability development for transitioning to the IT services model, while others struggled to do so. We use a multi-method approach consisting of four complementary stages for addressing the research question: (a) multiple case studies in eleven leading Japanese IT firms, (b) a large scale survey of division managers in 208 firms in Japan, (c) quantitative sequence analysis of archival product development logs for over 1,800 IT products in 208 Japanese firms during the ongoing transition, and (d) a Monte Carlo simulation of a subset of the insights obtained in the preceding stages.

Keywords: Capabilities, Competitive strategy, Qualitative research, Real Time Enterprise (RTE) Capabilities

Introduction

Firms that have historically been successful in the IT as a product paradigm of the IT industry are increasingly being pressured by the shift towards and emergence of IT as a service model (Ethiraj et al. 2005). For example, firms such as Sony and Toshiba in the Japanese IT industry have historically relied on an embedded IT model of product innovation in their high technology and automobile industries wherein software is inseparably embedded and integrated into electronics hardware. This studies the evolution of the Japanese IT and electronics industry as firm attempt to shift from IT product capabilities to IT services capabilities. The Japanese industry has rarely been directly used as a setting to understand MIS phenomenon and offers unique theory development opportunities as a virtue of its highly evolved technology products industry that is faced with a discontinuity in the shift towards IT services.

The focal question that we address is about how firms transition their IT product capabilities to IT services capabilities. In particular, we were interested in exploring the unexpected observation that some incumbent firms in the Japanese IT industry were able to leapfrog capability development for transitioning to the IT services model, while others struggled to do so. In other words, we casually observed a contradiction of the "innovator's dilemma" in some firms, although the majority of firms evolved in accordance with that popular prescription. This raised our interest in the unexplored question of how firms leapfrog in their IT capability development for adapting their IT capabilities to the digital services era. Given the absence of prior research on leapfrogging in IT capabilities, our research design was necessarily theory development focused rather than theory testing focused. It was also inductive rather than deductive, although we build on existing ideas in the literature on IT capabilities (Sambamurthy, Bharadwaj, and Grover 2003), IT services models (Rai and Sambamurthy 2006), and path dependence and dynamic capabilities (Teece, Pisano, and Shuen 1997) in order to understand our field based empirical materials (Alvesson and Kärreman 2007). We explore this question through a multi-method exploratory field study spanning seven years. The research began with a cross-case analysis of multiple cases in Fujitsu, Toshiba, IBM Japan, and Hitachi. This is followed by an exploratory survey in 208 companies in the IT industry in Japan and then sequence analysis of project level archival log data for 1,800 IT and electronics product development projects in 208 firms in Japan (ongoing).

The focal research question addressed in this ongoing study is the following: ***How do firms transitioning from embedded IT product models leapfrog the capability development process to develop capabilities to compete in the emerging IT services industry?***

To address this question, this research studies the Japanese IT industry, which historically has been a highly IT intensive industry in their products paradigm. The industry has historically competed by embedded IT into its products, particularly leveraging the strengths of its electronics industry. As the business models evolve from embedded IT products to a more digital services oriented model, we see increasing attempts among Japanese high technology firms to evolve into an IT services paradigm. This makes the Japanese industry uniquely suited to addressing this research question. We use a multi-method (Mingers 2001) approach consisting of four complementary stages for addressing the research question: (a) multiple case studies in eleven leading Japanese IT firms, (b) a large scale survey of division managers in 208 firms in Japan, (c) sequence analysis of archival product development logs for over 1,800 products during the ongoing transition, and (d) a Monte Carlo simulation of a subset of the insights obtained in the preceding stages. The data collection has been completed for the large scale survey and results from the initial data analysis some of the sequence analysis will be ready in time for the conference.

Theory Development

We define *IT product capabilities*, building on existing conceptualizations of IT capabilities (Bharadwaj 2000; Feeny and Willcocks 1998), as the capacity of a firm to leverage combinations of its IT infrastructure (e.g., hardware and software assets) and human IT skills to competitively differentiate its

product offerings in the marketplace. An example in the technology product industry would be a firm like Sony using its IT product capabilities to deliver a more user-friendly or feature-laden product such as a digital camera or cellular phone. Building on Rai and Sambamurthy (2006), we define *IT services capabilities* as a firm's structures and processes for conceiving, architecting, orchestrating, and delivering digital services to its customers. Thus the emphasis of IT product capabilities is on leveraging IT assets/ resources and skills in product offerings whereas the emphasis of IT service capabilities is on structures and processes used to deliver end-to-end digital services in the marketplace. An example of an IT service capability would be a firm such as Sony using its IT service capability to deliver a better end-to-end electronic book consumption experience that it harder for its competitors to readily replicate. The transition from a product to service oriented capability therefore requires transitioning, expanding, and combining existing IT assets and skills into structures and processes that allow the firm to offer IT services beyond what a competitor without those IT product capabilities might be able to offer in the marketplace. In other words, it requires leveraging existing IT product capabilities as a foundation for competitive actions in service-oriented offerings (Sambamurthy et al. 2003).

The significance of the shift towards IT as a service stems from the fundamental changes in how a firm sustainably derives economic rent in the marketplace and the underlying differences in how the production of services in managed. Table 1 summarizes the key differences between IT products and IT services. Unlike IT products, IT services are produced nearly instantaneously before their consumption (e.g., Web services), often involve co-production with specialized partners and even customers, rely more heavily on a persistent revenue stream rather than unit sales, which often requires ongoing feature innovations and service enhancements on shorter cycle times vis-à-vis new product releases (Nambisan 2001; Rai and Sambamurthy 2006). Illustrative examples of this transition are increasingly common in both the consumer markets (e.g., browser-based software functionality and subscription-based mobile apps) and corporate markets (the transition from software applications to platform-independent services). Finally, while IT products can vary considerably in their potential for locking in customers, this potential is considerably higher in IT services. For example, Netflix, iTunes, and Amazon have successfully created some degree of lock in through a combination of their deep knowledge of individual customers that they exploit to fine tune service offerings and a careful choice platform architecture and interface standards (Tiwana et al. 2010). The consequences for incumbent firms that fail to make this transition is the risk of using a product-oriented mindset or business model to deliver service offerings. In other words, there is considerable risk of failure in using an outmoded production and revenue generation approach to compete in IT services market environments.

Table 1: Salient Attributes that Differentiate IT Products from IT Services.

Attribute	*Product*	*Service*	*Representative Reference*
Time lag between production and consumption	Non-zero	Nearly zero	(Rai and Sambamurthy 2006)
Production emphasis	New product development	Collaborative co-production with specialized partners and customers	(Rai and Sambamurthy 2006)
Dominants costs	Fixed costs	Variable costs	(Nambisan 2001)
Revenue model	Unit sales	Revenue stream, often subscription-based	(Nambisan 2001)
Offering enhancement	Discrete new product releases	Ongoing service enhancements	(Nambisan 2001)
Lock-in potential	Low to moderate	High	(Nambisan 2001)

Leapfrogging is defined as a firm level strategy that focuses on overcoming the challenge faced by an incumbent firm in competing with early-mover competitors with established service-oriented business models (Cho et al. 1998) as well a pure-play services competitors (i.e., firms that started out with a service-oriented business model). These involve actions that either help overcome late entrant disadvantages or better utilize late comer advantages (e.g., vicarious learning from the experience of early mover competitors) (Cho et al. 1998; Mascarenhas 1992). Our emphasis in particularly on the latter i.e., wherein IT product-focused firms were surprised by the pace of the shift towards IT services-focused business models but were able to transition their pre-existing product-oriented capabilities into service-oriented capabilities in ways that their competitors could to readily replicate. Theoretically, leapfrogging in our conceptualization is akin to a path-breaking change vis-à-vis path a dependent change in the evolution of a firm's capabilities (Karim and Mitchell 2000). An example of capability leapfrogging is Apple's late entry into the digital music industry, which it subsequently grew to dominate by leveraging and uniquely integrating its iOS hardware devices with its proprietary music distribution platform (iTunes Store). Our theory development emphasis is on how established incumbent firms in IT product industries transition their capabilities to an IT services paradigm, particularly how they bypass or leapfrog intermediate steps in progressing along such evolutionary paths relative to new entrants.

Research Methodology

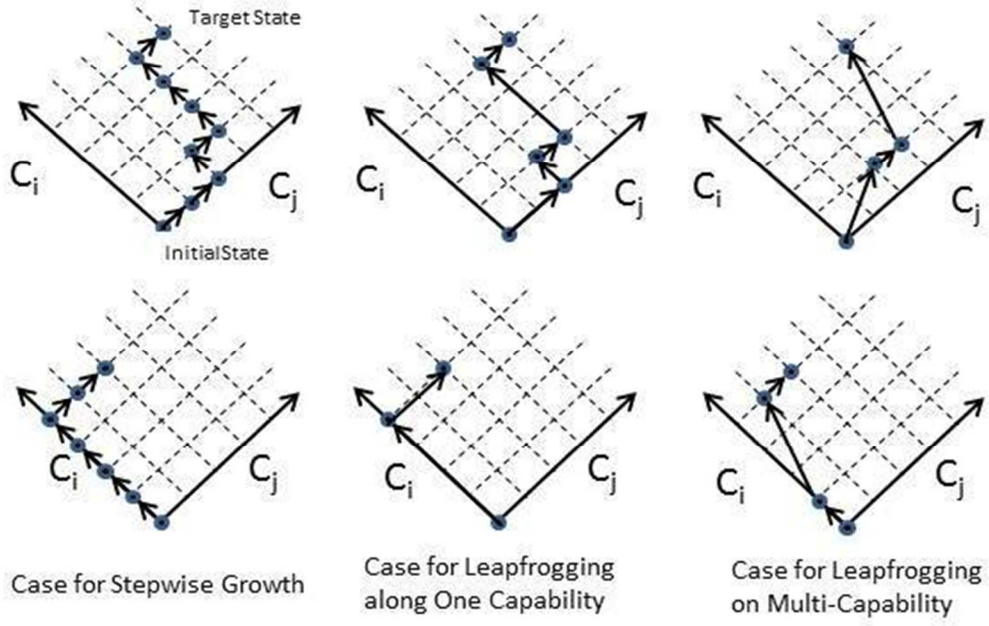
The research methodology used in the study is a multi-year, multi-method approach. The unit of analysis of the study is the corporate division. Data collected during the multi-year data collection process therefore were aggregated to the level of a corporate division of the firm. Table 2 provides an overview of the major stages of data collection in this multi-year study. The primary goal of the study is to understand how firms that are established in IT product industries transition their capabilities to an IT services paradigm. The key patterns of particular interest is how such firms bypass or leapfrog intermediate steps in progressing along such evolutionary paths relative to new entrants. The traditional assumption is that incumbent firms face legacy challenges that arise from their assimilation of practices that served them well in preceding eras in their industry in earlier industry lifecycles but that these become blinders vis-à-vis greenfield entrants. In contrast, initial observations of highly IT intensive firms in the Japanese electronics industry show that some incumbent firms indeed successfully leapfrog Greenfield firms in the capability development process.

Stage 1: Cross-case data using semi-structured interviews. The first stage was initial semi-structured interviews with 20 managers in the divisions of seven major Japanese companies that did successfully appear to leapfrog the capability development process from IT products to IT services. The objective was to gain deeper insights into the conditions and precursors for capability leapfrogging to occur. The companies included in this stage of the research were Hitachi, IBM Japan, NEC, Fujitsu, and Toshiba. These interviews were recorded in Japanese and transcribed for cross-case analyses.

Stage 2: Perceptual survey across the broader sample of Japanese technology firms. In conjunction with this qualitative data, we collected data in Stage 2 from a broader sample of Japanese IT and electronics firms (many members of Japan Electronic and IT industry Association). The objective is to collect a retrospective account of the evolution trajectory and managers perceptions of evolution in the IT capabilities required in the marketplace. We received 200 responses from the 2,000 firms we contacted for a response rate of about 10%. 168 of these responses were usable that the rest discarded due to substantial missing data. We are in the preliminary stages of exploratory analysis, which will explicitly account for non-independence among some of the observations.

Stage 3: Sequence analysis of archival log data on 1,800 projects. This perceptual data from Stage 2 will eventually be combined with objective project-level log data on new IT-based products and services in these firms. Meticulous project records are the norm in the Japanese engineering departments and the records are accessed in an form that protects the proprietary details of the projects through redaction and via the support of the Japanese IT industry consortium. The logged archival data will be coded and then subjected to quantitative sequence analysis techniques adapted from DNA sequence analysis in the genetic sciences. The objective is to use the large volume of data to discern patterns that led to capability leapfrogging, using (Sabherwal and Robey 1993) as the starting point for our approach. To assess leapfrogging, we plan to examine the data to detect the use of an IT capability to skill that is not preceding by an earlier, precursory capability. Figure 3 below illustrates patterns of capability evolution

across different time periods across six firms for one IT capability. We are currently in the process of collecting and then coding the archival log data. The next steps include coding each project log and to determine an exhaustive and theoretically parsimonious set of IT capabilities in the data. The coding will use at least two raters with deep familiarity with the Japanese IT industry to be able to assess inter=rater reliability.



Stage 4: Monte Carlo Simulation: In the final stage, we will construct a Monte Carlo simulation to refine the insights generated from the first three stages of the study through a narrowly focused simulation. This stage will directly build on the results from the preceding stages.

Table 2. Overview of Research Data Collection Stages

	Method Used	N
Stage 1	Semi structured interviews with 20 IT division managers in 7 Japanese firms	20
Stage 2	Perceptual evaluations of IT capability evolution using a survey of 208 Japanese firms	208 firms
Stage 3	Sequence analysis of archival IT project log data in from SMI repository	Approx 1,800 projects in 208 firms
Stage 4	Monte Carlo simulation to complement sequence analysis and survey data analysis	N/A

Expected Contributions and Conclusion

The expected contributions of the study are new insights into how firms that are well entrenched in the IT product model leapfrog into the IT services era. The theoretical insights expected are primarily into the sequences of vacillation between different modes of capability development and retirement as firms transition, augment, or reconstruct from capabilities from the product industry era that become obsolete. We also hope to provide new insights into approaches through which such firms leverage outgoing

capabilities as the starting point for developing new IT capabilities, and the conditions that are conducive to using them as a leapfrogging point. The complexity of the question required the use of a multi-year, multi-method design spanning sequence analysis of product development logs, interviews, and survey data. We expect the findings of this study, particularly those on IT capability leapfrogging, to complement the existing theoretical perspectives on IT capabilities (Sambamurthy, Bharadwaj, and Grover 2003), organizing IT services (Rai and Sambamurthy 2006), and path dependence in dynamic capabilities (Teece, Pisano, and Shuen 1997). (We expect to have initial insights based on our preliminary analysis for ready for discussion by the time of the conference.)

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